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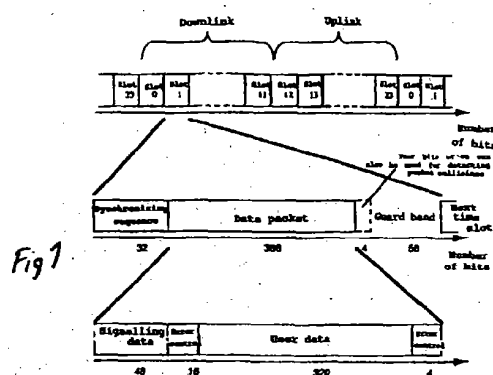
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(54) Arrangement for a TDMA/TDD radiocommunication system with a structure for combining time slots.

(57) In a radiocommunications system of the DECT type, one or more of the functions of the system are improved, for example range, time delay, time dispersion, etc. The system operates with a TDMA/TDD structure and with time slots for transmission of, inter alia, data. Two adjacent time slots are combined to form a double time slot. In one embodiment, a time slot is embedded in a double time slot.



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US 5 200 955 shows a repeater for a mobile radio system which uses TDMA. The repeater is used to increase the coverage area/the communication distance by means of amplifying channels in an area with poor field strength.

US 5 265 150 relates to a cordless PBX system, for example for cordless telephony. The system consists of a number of fixed terminals and cordless telephones. The terminals can be placed anywhere, and the system automatically configures itself for optimum functioning. Certain terminals can function as repeaters in order to extend the coverage area.

US 5 152 002 describes a system and a method for extending the coverage area for a base station. A number of repeaters are placed in the area in which coverage is desired. The repeaters can be used in order to amplify the same frequency or to convert to another frequency.

US 4 549 293 shows a cordless communications system which uses TDMA. The system consists of a number of radio terminals (transceivers) which can be used either as master or slave. When a terminal is used as slave, directional antennas are used for communication to the master.

DESCRIPTION OF THE INVENTION

TECHNICAL PROBLEM

This document focuses on how the TDMA/TDD structure built into DECT can be used to achieve greater radio range and "robustness". The solution should be able to complement the abovementioned repeater, for example.

The technical problem thus lies in the limitations which the TDMA/TDD structure of DECT, with chosen parameter values, places on the radio range and more generally "robustness".

SOLUTION

The main object of the present invention is to propose an arrangement which solves the problems cited above, and the features which can principally be regarded as being characteristic of the invention are evident from the patent claims attached.

DESCRIPTION OF THE FIGURES

A presently proposed embodiment of an arrangement which has the characteristics significant to the invention will be described hereinbelow with reference to the attached drawings, in which

Figure 1 shows a diagram of the TDMA/TDD structure in DECT,

Figure 2 shows in part the DECT system, in which the DECT "Fixed Point" consists of one or more repeaters RFP and a central fixed part CFP

which is termed radio controller, and in which a unit PPX used can constitute a local exchange LX representing part of the public local network,

Figure 3 shows a diagram of the original time slot structure for DECT at a), and how a slot (0', 1' etc) can be embedded in a combined double time slot at b), and

Figure 4 shows an example of the use of directional antennas and repeater in combination, in which the repeater is the unit seen on the far left inside the house (the proposal shows how the range can be increased).

DETAILED DESCRIPTION OF THE INVENTION

The DECT standard specifies the so-called double slot (double time slot). This involves two adjacent slots being joined together so that they are used as a "long" time slot, with more than twice the amount of data available, totalling about 80 kbit/s. This is possible because it is not necessary to repeat synchronization and signalling data. The double slot is created from the start in order to increase the capacity in DECT when DECT is used as access to, for example, ISDN, but it has been found that, from these points of view, there has been considerably less need for the double slot than was anticipated.

The double slot in DECT is hedged by a number of limitations, for example it is expressly specified that the double slot may not be used for PCM.

It should be possible for the double slot to be used in order to lessen the problems of time delay and time dispersion and in order to increase the "robustness" in very general terms. Probably the most cost-effective way is to "embed" a normal (single) time slot in a double one (see Figure 3). This should permit the use of the DECT standardized speech coders and other subsystems, and in particular the "original" time slot can be scaled up and used in repeaters, RFPs, without further processing.

In this way the time delay can be increased from approximately 0.02 ms (see above) to a maximum of 0.4 ms (a further 388 bits can be used for synchronization and time compensation, totalling about 400). This is for a double slot ($\approx 2 \cdot 480$ bits), of which there are only 6+6 in a frame; the maximum time delay can thus be estimated at $(400/960) \cdot (10/12) = 0.4$ ms).

This time delay corresponds to 60 km, which is more than is to be realistically expected for other reasons (field strength, for example). The number of "extra" sync bits for synchronization can thus be set at about 150 (\Rightarrow max time delay 0.17 ms corresponding to about 25 km). The remaining "extra" 238 bits can then be used for other signalling, for use in, for example, Telepoint or "limited-area local access" (an intermediate form between RLL and Telepoint). The extra bits can also be used for increased error correction.

The contexts for which the invention is primarily

acterized in that extra bits, for example 238 bits, remaining due to the combination to form double time slots, take part in other signalling, for example for use in the Telepoint system or limited-area local access and/or for establishing extended error correction.

10. Arrangement according to any one of the preceding patent claims, characterized in that it can be used in contexts where the drop in capacity in the system due to the double time slot/double time slots is of minor significance, for example in systems for radio in the local loop (RLL), Telepoint systems, etc.

11. Arrangement according to any one of the preceding patent claims, characterized in that it can be used in cases where extended range is of interest, for example in joint use with directional antennas in relation to which the arrangement is to be considered as fixed.

12. Arrangement according to any one of the preceding patent claims, characterized in that the double time slot is used between base station/fixed station and the equipment which has been installed in a fixed position at the home of, or in the direct vicinity of, a user (repeater or installed fixed DECT unit), all time compensation, rearrangement of time slots, etc. being carried out in the base station, and the repeater or repeaters only needing to handle the double time slot.

13. Arrangement according to any one of the preceding patent claims, characterized in that by means of each repeater the users of the arrangement/system obtain full local mobility, for example around the dwelling, and by using a directional antenna or directional antennas the link budget between the base station, or equivalent, and each repeater shows an improvement of up to about 40 dB, which fact can itself be used to increase the distance between the base station and each repeater from about 2 km to 10 - 20 km.

14. Arrangement according to any one of the preceding patent claims, characterized in that each base station is installed in or placed upon a tall structure (radio tower, radio mast, water tower) and each repeater is placed high up on a house, lamp post, etc.

15. Arrangement according to any one of the preceding patent claims, characterized in that the double time slot offers increased robustness, an error correction possibility, etc., in a built-up environment, possibly together with repeater and/or directional antennas.

16. Arrangement according to any one of the preceding patent claims, characterized in that in a less built-up area/environment, with low but important traffic, the distance between each base station and repeater is chosen to be relatively great.

17. Arrangement according to any one of the preceding patent claims, characterized in that the double time slot contains, in addition to the data mentioned, data information for authentication, debiting, etc.

18. Arrangement according to any one of the preceding patent claims, characterized in that the double time slot is known per se in the system, but is used for other purposes.

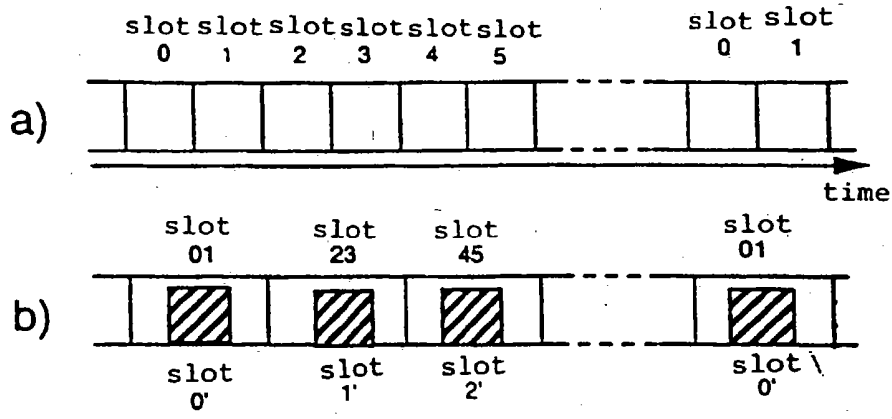


Fig 3

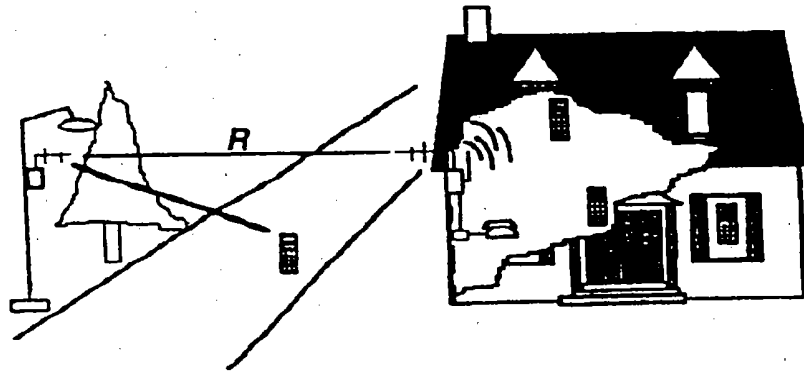
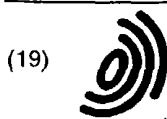


Fig 4



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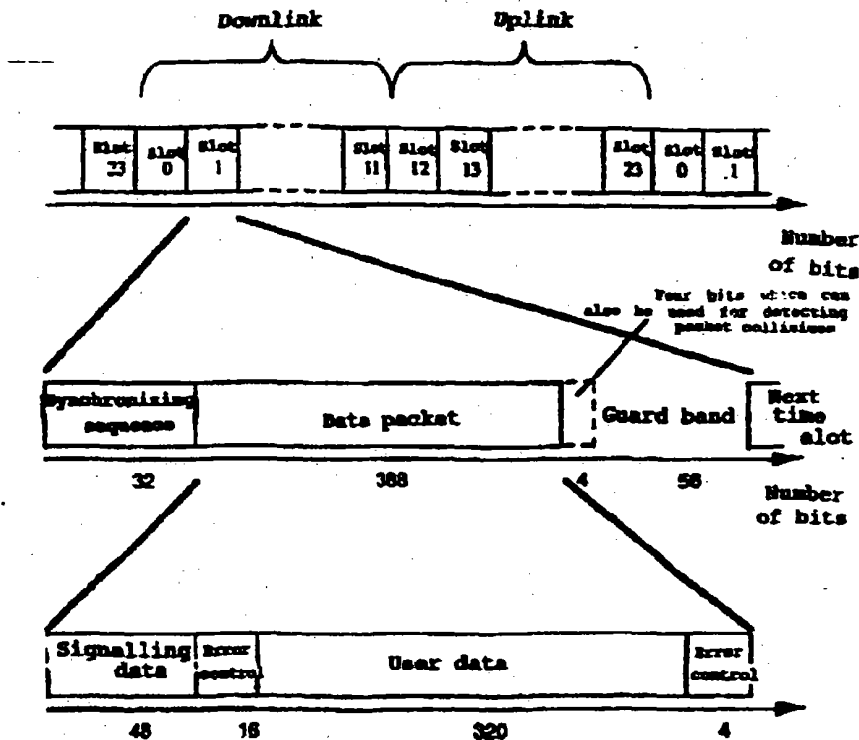
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Fig 1



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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 95 85 0041

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

12-04-2000

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

